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Abstract

The choice of an exchange rate peg often points to a trade-off between gaining credibility and losing flexibility. We show that the flexibility loss may be reduced if domestic and foreign shocks are coorelated and *more* volatile. Allowing for a plausible structural change after a peg, a flexibility *gain* may result.

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1 Introduction

The choice between fixed or floating exchanges rates in small open economies is a long-standing controversial issue. Among the arguments in favor of fixed exchange rates are those pointing to the benefits of nominal stability *per se,* and that high inflation can be brought down by "piggy-backing" on the monetary policy of a "disciplined" anchor country (Garber and Svensson, 1995). Such *credibility gains*, are typically weighted against the *loss of flexibility* emerging if the pegging country needs to respond to idiosyncratic shocks. I.e., a credibility vs. flexibility trade-off is usually guiding the choice as in any conventional "rules versus discretion" debate in monetary policy design; cf. Genberg (1989) and Persson and Tabellini (2000, Chap. 17).

The purpose of this note is to qualify this conventional wisdom in several dimensions. First, we introduce a shock in the anchor country, which spills over onto the pegging country. Assuming that this shock is not uncorrelated with a shock in the pegging country, the loss of flexibility may be diminished. An important result is that a negative correlation between the pegging country's shock and the spill-overs from the foreign shock makes pegging more attractive.[1] In particular, we show that the external shock in that case serves as an imported "output stabilization device" under a peg. Secondly, we show that — depending on the correlation between shocks — more volatile shocks may *reduce* the loss of flexibility and thus make the case for pegging stronger.[2]

Finally, we examine a case where an exchange rate peg alters the structure in the pegging country by enhancing nominal rigidities. Then, it may even be the case that if shocks are not uncorrelated, macroeconomic stabilization is *more* favorable when giving up monetary autonomy compared to a situation of independent policy, and thus, floating exchange rates. I.e., the credibility vs. flexibility trade-off vanishes and a peg may become a "free lunch."

2 Monetary policy under floating exchange rates

For our purposes, it is suitable to consider a standard one-period model of credibility problems in monetary policy (cf. Kydland and Prescott, 1977; and Barro and Gordon, 1983). In a small open economy, log of output, y, is given by a conventional Lucas supply schedule

$$y = \alpha\left(\pi - \pi^e\right) + \varepsilon, \qquad \alpha > 0, \tag{1}$$

[1] This, however, does *not* necessarily require that business cycles are asynchronous. The negative correlation can, as will be clear from the model, arise from positively correlated supply shocks, where the external shock is being stabilized by monetary policy in the anchor country. Then, it spills over onto the pegging country as a monetary shock with the opposite sign of its own supply shock.

[2] Recently, Berger *et al.* (2000) have provided empirical support for this rather surprising prediction of our model. They find for a panel of 65 non-OECD countries that the volatility of output growth in both pegging and anchor countries are (parts of a set of) robust predictors of exchange rate regime choice.

where π and π^e denote actual and expected inflation, respectively, and α is a proxy for nominal rigidities; i.e., the extent to which unanticipated inflation has real effects. Inflation expectations are formed in the beginning of the period as private agents sign nominal contracts. Subsequently, the economy is hit by a shock, ε, which is assumed to have zero mean and variance σ_ε^2. Thereafter, the monetary authority conducts monetary policy. To simplify, it is assumed that the authority controls inflation directly. The model is closed by a stochastic version of the purchasing power parity condition:

$$\pi = e + \pi^* + \phi, \tag{2}$$

where e is the rate of nominal exchange rate depreciation, π^* is the foreign inflation rate, and ϕ is a mean-zero shock with variance σ_ϕ^2. π^* is known when π^e set, while ϕ is not. The shock ϕ can be interpreted in a number of ways. It may represent a change in the world relative demand for domestic goods. Also, it can be viewed as a stochastic part of foreign monetary policy, e.g., through its response towards foreign supply shocks feeding into foreign inflation. We interpret it as a broad term for foreign business cycle spill-overs onto the domestic economy. No matter the particular rationalization of the shock, there are no *a priori* reasons for making particular assumptions about the correlation between ε and ϕ. Indeed, the fact that ε and ϕ need *not* be uncorrelated will play an important role for the exchange rate regime choice.

The aim of monetary policy it to minimize deviations of output and inflation from their target levels, $y^* > 0$ and zero, respectively. The target level for output is above the natural rate reflecting the presence of some fixed distortions in the economy (for example, the deadweight loss of taxation or labor market inefficiencies). Assuming a zero optimal rate of inflation is without loss of generality. The loss function of the authority thus takes the familiar form:

$$L = \mathrm{E}\left[\lambda\,(y - y^*)^2 + \pi^2\right], \qquad \lambda > 0, \tag{3}$$

where E[.] is the expectations operator. The time-consistent rational expectations equilibrium is readily found as

$$\pi = \lambda\alpha y^* - \frac{\lambda\alpha}{1+\lambda\alpha^2}\varepsilon, \qquad y = \frac{1}{1+\lambda\alpha^2}\varepsilon. \tag{4}$$

This equilibrium features the usual inflation bias since the monetary authority has the — under rational expectations futile incentive — to conduct expansive monetary policy to raise output.[3] Moreover, (4) shows that the authority to some extent stabilize the economy when an output shock hits. Finally, it is evident that foreign inflation and the spill-over shock do not affect the domestic economy, as variations in these variables are absorbed by exchange rate movements under floating rates.

[3] Recently, the inflation bias model has been subject to much critique, as it is argued that monetary authorities in reality do not try to raise output above the natural rate (see, e.g., Blinder, 1998). While this argument is trivially true when describing credible, low-inflation authorities, we apply the conventional setting as a simple allegory for monetary policy conduct by authorities suffering from a credibility problem.

To facilitate the subsequent comparison of floating and fixed exchange rates, we state the value of the authority's equilibrium loss under floating rates by inserting (4) into (3):

$$L^{FL} = \lambda y^{*2} + (\lambda \alpha y^*)^2 + \frac{\lambda}{(1+\lambda\alpha^2)^2}\sigma_\varepsilon^2 + \frac{\lambda^2\alpha^2}{(1+\lambda\alpha^2)^2}\sigma_\varepsilon^2. \tag{5}$$

3 Fixed exchange rates

If the domestic country decides to peg its exchange rate against the foreign currency it follows that $e = 0$. (This is assumed to be perfectly credible.) By (2), we then have $\pi = \pi^* + \phi$. The rational expectations outcome for output follows through combination of (1) and the expression for π as $y = \alpha\phi + \varepsilon$. Thus, the domestic economy is now subject to foreign inflation and the spill-over shock as the exchange rate can no longer adjust to neutralize their impact. The authority's loss from being in a fixed exchange rate regime is found as

$$L^{FIX} = \lambda y^{*2} + \pi^{*2} + \lambda\left[\sigma_\varepsilon^2 + \alpha^2\sigma_\phi^2 + 2\alpha\rho_{\varepsilon\phi}\sigma_\varepsilon\sigma_\phi\right] + \sigma_\phi^2, \tag{6}$$

where $\rho_{\varepsilon\phi}$ is the correlation coefficient of ε and ϕ. Note that this correlation plays a crucial role for the magnitude of the loss arising from output volatility [the third term in (6)]. For example, in the case where the shocks are perfectly negatively correlated ($\rho_{\varepsilon\phi} = -1$), output variance is given by $(\alpha\sigma_\phi - \sigma_\varepsilon)^2$. Hence, if $\sigma_\phi = \sigma_\varepsilon/\alpha$ one has an example where domestic output is completely stable even though the country has given up monetary policy autonomy. Although a special case, it demonstrates that giving up policy independence is not necessarily associated with disastrous stabilization losses.

4 Exchange rate regime choice

We now consider the optimal choice of exchange rate regime. Fixing the exchange rate is advantageous if $L^{FIX} < L^{FL}$. Using (6) and (5), this requirement becomes

$$(\lambda\alpha y^*)^2 - \pi^{*2} > \lambda\left[\sigma_\varepsilon^2 + \alpha^2\sigma_\phi^2 + 2\alpha\rho_{\varepsilon\phi}\sigma_\varepsilon\sigma_\phi\right] - \frac{\lambda}{(1+\lambda\alpha^2)^2}\sigma_\varepsilon^2 + \sigma_\phi^2 - \frac{\lambda^2\alpha^2}{(1+\lambda\alpha^2)^2}\sigma_\varepsilon^2. \tag{7}$$

The left-hand side exhibits the regime difference in terms of losses from average inflation. The first two terms on the right hand side depict the regime difference in terms of losses from output variance. Finally, the last two terms are the regime difference in terms of inflation variability.

The right-hand side is non-negative, and reflects the overall *loss of flexibility* in responding towards shocks by giving up monetary autonomy.[4] Hence, for fixed exchange

[4] To show that the right-hand side is never negative, note that it is most likely to be negative when $\rho_{\varepsilon\phi} = -1$. In that case, the value of σ_ϕ that minimizes the right-hand side is $\sigma_\phi = \left[\lambda\alpha/\left(1+\lambda\alpha^2\right)\right]\sigma_\varepsilon$. This is obvious under the interpretation that σ_ϕ represents imported foreign inflation volatility: when shocks are identical in absolute magnitude, the most favorable inflation volatility is indeed the one under floating rates, cf. (4). With this value of σ_ϕ, the right-hand side is zero for all λ, α, and σ_ε, while for *any* other value it is positive.

rates to be desirable at all, it is necessary that the left-hand side of (7) is positive. This is assumed throughout and amounts to an assumption of the existence of a *credibility gain* from fixed exchange rates such that average imported inflation is lower than the domestic inflation bias under floating rates. Hence, (7) states that a peg is beneficial if the credibility gain outweighs the loss of flexibility. This is clearly not a new result. But we now highlight some new results concerning the determinants of this trade-off with particular emphasis on the flexibility loss.

The correlation between shocks turns out to be crucial, as evident by the following:

Proposition 1 *The case for fixing the exchange rate is strengthened if the correlation between the domestic and the spill-over shocks is negative, i.e., if* $\rho_{\varepsilon\phi} < 0$.

Behind this result is the fact that if $\rho_{\varepsilon\phi} < 0$, the spill-over shock will act as an automatic output stabilization device for the domestic economy as shown in the former section. The existence of such a device thus clearly increases the attractiveness of a fixed exchange rate regime, as the loss of flexibility is reduced.

Next, we examine how the regime choice is affected by the volatilities of the shocks *per se*. Immediately, one would conjecture — with reference to the usual "credibility gain vs. stability loss" catch phrase — that higher volatilities are unambiguously bad under a peg, thereby making floating exchange rates more desirable. With non-zero correlation of shocks this may not be the case:

Proposition 2 *An increase in the standard deviation of the domestic or spill-over shocks unambiguously weakens the case for a fixed exchange rate if and only if correlation of shocks is non-negative; more precisely,*

(a) increased σ_ε *weakens the case for pegging iff* $\sigma_\varepsilon > -\dfrac{1+\lambda\alpha^2}{\lambda\alpha}\rho_{\varepsilon\phi}\sigma_\phi$,

(b) increased σ_ϕ *weakens the case for pegging iff* $\sigma_\phi > -\dfrac{\lambda\alpha}{1+\lambda\alpha^2}\rho_{\varepsilon\phi}\sigma_\varepsilon$.

Proof. *Taking the derivative of the left and right hand sides of inequality (7) with respect to* σ_i, $i = \varepsilon, \phi$, *respectively, and reversing the inequality sign immediately leads to conditions (a) and (b).* ∎

Proposition 2 implies that if the correlation between the shocks is negative, higher variances of either shock may *not* weaken the case for a peg. In the case of a higher σ_ε, this occurs if σ_ϕ is relatively high and inflation stability is given high priority (i.e., λ is small). This is because when inflation stability is highly valued, the negative effects of ε is of less importance under either regime. But — all things equal — with a high variability of ϕ, the imported output stabilization under a peg when $\rho_{\varepsilon\phi} < 0$ will be high. Therefore, if σ_ε is not too large, output becomes more stable under a peg when σ_ε increases.

In the case of a higher σ_ϕ, the case for pegging is not weakened if σ_ε is relatively high and output stability is given high weight (i.e., λ is large). This follows because if inflation stability is less valuable, the imported inflation variance through ϕ is of minor importance. Instead, the output stabilizing impact of ϕ makes pegging more attractive when σ_ϕ increases, and more so the higher is σ_ε (provided that σ_ϕ is not too large).

5 Structural change after a peg

A richer evaluation of the implications of adopting a fixed exchange rate should acknowledge that private sector behavior may respond to regime changes. In this model, the main systematic change by adopting a peg is lower average inflation. Recent theoretical and empirical work suggest that this affects the degree of nominal rigidity. For example, Ball *et al.* (1988), Dotsey *et al.* (1999) and Hutchison and Walsh (1998), present various theoretical arguments stating that with lower average inflation, rigidities become more profound.[5] In our model, this corresponds to a higher value of α, denoted in the following by $\widetilde{\alpha} > \alpha$ (this may be interpreted as a higher sacrifice ratio). By assumption, when adopting a peg, the output equation then changes to the following:

$$y = \widetilde{\alpha}\left(\pi - \pi^e\right) + \varepsilon, \qquad \widetilde{\alpha} > \alpha. \tag{8}$$

When (8) applies, the loss under fixed exchange rates becomes $L^{FIX} = \lambda y^{*2} + \pi^{*2} + \lambda\left[\sigma_\varepsilon^2 + \widetilde{\alpha}^2\sigma_\phi^2 + 2\widetilde{\alpha}\rho_{\varepsilon\phi}\sigma_\varepsilon\sigma_\phi\right] + \sigma_\phi^2$, and pegging is therefore preferable if

$$(\lambda\alpha y^*)^2 - \pi^{*2} > \lambda\left[\sigma_\varepsilon^2 + \widetilde{\alpha}^2\sigma_\phi^2 + 2\widetilde{\alpha}\rho_{\varepsilon\phi}\sigma_\varepsilon\sigma_\phi\right] - \frac{\lambda}{\left(1+\lambda\alpha^2\right)^2}\sigma_\varepsilon^2 + \sigma_\phi^2 - \frac{\lambda^2\alpha^2}{\left(1+\lambda\alpha^2\right)^2}\sigma_\varepsilon^2. \tag{9}$$

Compared to (7), we see that in (9) the loss of output fluctuations under a peg involves $\widetilde{\alpha}$ instead of α. The implication of this is:

Proposition 3 *When $\widetilde{\alpha} > \alpha$ and $\rho_{\varepsilon\phi} < 0$ there may be a gain in flexibility by adopting a fixed exchange rate.*

Proof. *To prove this, we must establish that the right-hand side of (9) can be negative. Since $\rho_{\varepsilon\phi} = -1$ is most conducive for this, the proposition is invalid if*

$$\lambda\left[\sigma_\varepsilon^2 + \widetilde{\alpha}^2\sigma_\phi^2 - 2\widetilde{\alpha}\sigma_\varepsilon\sigma_\phi\right] - \frac{\lambda}{\left(1+\lambda\alpha^2\right)^2}\sigma_\varepsilon^2 + \sigma_\phi^2 - \frac{\lambda^2\alpha^2}{\left(1+\lambda\alpha^2\right)^2}\sigma_\varepsilon^2 < 0$$

is violated. This condition reduces to $\lambda\left(\sigma_\varepsilon - \widetilde{\alpha}\sigma_\phi\right)^2 + \sigma_\phi^2 < \left[\lambda/\left(1+\lambda\alpha^2\right)\right]\sigma_\varepsilon^2$. The value of $\widetilde{\alpha}$ that minimizes the left-hand side is $\sigma_\varepsilon/\sigma_\phi > 0$, while the value of α that maximizes the right-hand side is 0. For these values, the condition becomes

$$\sigma_\phi^2 < \lambda\sigma_\varepsilon^2, \tag{10}$$

which cannot be ruled out. Hence, a parameter configuration exists with $\widetilde{\alpha} > \alpha$ and $\rho_{\varepsilon\phi} < 0$ where the right-hand side of (9) is negative. ■

[5] Fischer (1995), Hutchison and Walsh (1998) and Posen (1998) present empirical results supporting this claim to various extents. Cukierman (1998), though, criticizes this body of empirical evidence.

The intuition for this proposition, and (10), is that if α is low, society's loss under floating rates will be close to $\lambda\sigma_\varepsilon^2$, and predominantly caused by output volatility (inflation will hardly respond to ε as policy is almost ineffective when α is small). If ε and ϕ are close to perfectly negatively correlated, and if a peg entails an increase in α, output stabilization is improved. The only downside of a peg is the imported inflation volatility implying a loss of σ_ϕ^2. Then, if $\sigma_\phi^2 < \lambda\sigma_\varepsilon^2$, a peg is preferable from a pure stabilization point of view.[6] Moreover, as policy is imported from abroad, an increase in α does not increase average inflation as it would under floating exchange rates, cf. (4). Therefore, a peg may become a "free lunch" — contrary to the conventional wisdom alluded to in the Introduction — providing gains in terms of lower inflation *and* better macroeconomic stabilization.

[6] Note that this condition is always fulfilled in the special case of $\sigma_\phi = \left[\lambda\alpha/\left(1+\lambda\alpha^2\right)\right]\sigma_\varepsilon$, which for perfectly negatively correlated shocks implies no stabilization loss of pegging for unchanged α (cf. Footnote 4). Then, better stabilization policy induced by the envisaged increase from α to $\widetilde{\alpha}$ under fixed exchange rates constitutes a welfare gain.

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